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25X1A

INSTRUCTIONS FOR USING THE [redacted] FILAR
EYEPIECE WITH THE [redacted] HIGH POWER STEREOVIEWER
(TWIN DYNAZOOM MICROSTEREOSCOPE)

25X1A

A. INTRODUCTION.

25X1A [redacted] filar eyepieces for linear measurement and gonimeter eyepieces for angular measurement are now available for use on the

25X1A [redacted] High Power Stereoviewer. A minor modification to the Dynazoom barrels permits attachment of the eyepieces to either barrel. The goniometer eyepiece is operated by rotating a reticle in relation to a 360° scale which is clamped to the microscope tube.

Extreme caution must be exercised when making distance measurements with the filar eyepiece. The operator should be certain that only one zoom and objective setting is used for each set of calculations, since the slightest alteration of the variable magnification is enough to invalidate the results. Consequently, a preliminary examination of the area in which measurements are required is recommended to select the proper magnification for optimum resolution of the imagery. If stereo mensuration is desired, the special compensating eyepiece mated for each measuring eyepiece must be employed. This procedure provides for both optical path and color correction and eye relief equalization. All settings and accessories should be rechecked if the operator leaves his equipment during a measurement series.

B. DESCRIPTION.

25X1A The [redacted] Filar (or screw micrometer) eyepiece provides higher accuracy than simple, fixed scale micrometer eyepieces by means of a 15X compensating eyepiece matched with [redacted] objectives. A fixed 25X1A scale and a movable crosshair are visible in the view field. The crosshair consists of a "vertical" line completely bisecting the field and a short "horizontal" line defining the mid-point of the vertical one. One full turn of the micrometer causes the crosshair to move across one interval on the fixed scale. On its circumference this drum carries a scale of 100 intervals. To make use of the eyepiece, several calibrations and several measurements should be averaged.

C. CALIBRATING THE FILAR EYEPIECE.

Before making any measurements, it is necessary to know what actual ground distance on the image corresponds to one interval of the eyepiece scale. In order to determine this value, the following steps are taken.

(1) Select the desired magnification and remove the film from the stages.

(2) Replace the standard eyepiece with the filar eyepiece and focus with one eye on the filar scale by rotating the black knurled cap of the eyelens to the point of sharpest definition of the scale.

(3) Place a stage micrometer or precision scale on the Dynazoom stage beneath the filar eyepiece. Focus on the scale with the Stereoviewer coarse focus adjustment and align the stage micrometer with the filar micrometer scale. This may be done by rotating the filar eyepiece in the microscope tube. Subsequent stereoscopic image measurements will undoubtedly require filar eyepiece rotation, in any case.

(4) The eyepiece micrometer and the image of the object micrometer must be in the same plane, free from parallax. Check this by moving the head slightly. The two scales must not appear to move with respect to one another. The microscope fine focus adjustment must be used to eliminate all parallax.

(5) Adjust the X,Y traverse controls of the Stereoviewer stage until the zero line of the stage micrometer scale coincides with the zero line of the fixed filar micrometer scale. If the lines on the filar scale are much finer than those of the image of the stage micrometer, align the filar zero line with the <u>center</u> of the zero vertical line on the stage micrometer. From these coincident lines, scan across the superimposed scales to the number "10" line on the filar scale and read the corresponding scale indication on the stage micrometer. One interval of the eyepiece micrometer then corresponds to the ratio, R. where:

$$R = \frac{\text{Stage Micrometer Distance}}{10}$$

For example, if 10 intervals in the eyepiece coincided with 18 intervals in the stage micrometer, one eyepiece interval (R) would equal 18/10 stage micrometer interval, or 1.8.

During this process, it is best to ignore any dimensional indications on the stage micrometer, such as mm, inches, or decimal points. Merely count the discrete intervals subtended.

(6) To obtain an actual ground dimension, the stage/filar ratio (R) must be defined in terms of the specific photography used. This is done in two steps:

a. Multiply the absolute value of one stage micrometer interval (SI) by the scale factor (SF=reciprocal of the scale) of the photography to obtain the ground distance represented by one stage micrometer interval on the film imagery (SIg).

$$SI_g = SI \times S.F.$$

For example, if one stage micrometer interval equals 0.1 millimeter and the photo scale factor is 30,000, one stage micrometer interval equals 3,000 millimeters, or 3.0 meters.

b. ~~Then~~ multiply the ground stage micrometer interval (SIg) by the stage/filar ratio (R) to obtain the ground distance represented by one interval on the fixed filar scale (FIg).

$$FIg = SIg \times R$$

For example, using the values obtained above, one interval in the fixed filar scale equals 3.0 times 1.8, or 5.4 meters.

NOTE: These two steps, of course, can be combined into one formula, as:

$$FIg = SI \times S.F. \times R$$

D. MEASURING WITH THE FILAR EYEPIECE.

The value of FIg is then noted for all subsequent measurements performed in the area of the film in which the scale remains the same. Actual measurements on the photography are obtained by marking off the desired distance in the image with the movable hairline in the filar eyepiece. The following steps are necessary to perform each measurement:

(1) Start by placing the target image to be measured in the center of the field of view (defined by the movable filar crosshair when set to correspond with the "6" line of the fixed filar scale).

(2) Rotate the linear dimension of the image to be measured until it coincides with the "horizontal" (short) filar crosshair line. This may be accomplished with the optical image rotation control ring of the High Power Stereoviewer when measuring a monoscopic image; however, it is strongly recommended that the filar eyepiece be rotated to

accomplish this alignment when viewing a stereo pair (see E.2. below).

(3) Align the movable crosshair on the "right" edge of the image to be measured. Record the scale indication and the drum reading (FR_1).

(4) Move crosshair until it has aligned with the "left" end of the image. Care must be taken that the two "settings" are on a common subject in the stereo image. For example, measure the top or eaves of a building; The base of the building may only be used if there is no appreciable slope to the ground surface. Record the scale indication and drum reading. (FR_2)

(5) Subtract the second reading from the first.

For example if $FR_1 = 7.79$ and

$FR_2 = 3.50$, then

$FR = 7.79 - 3.50 = 4.29$ units.

(6) This total filar reading is then multiplied by the ground value obtained for one interval on the fixed filar scale (FIg) to obtain true ground distance (GD):

$$GD = FR \times FIg$$

For example, the values obtained above (FIg = 5.4 meters and FR = 4.29), give a ground distance of approximately 23.17 meters.

E. DISCUSSION OF PROBLEMS IN USING THE FILAR EYEPIECE WITH STEREOSCOPIC IMAGES.

(1) Since there are no common X, Y motions available on the High Power Stereoviewer, stereo fusion can be maintained only by concurrent movement of the corresponding X, Y controls on each stage. If the stereo image is misaligned, it can be corrected by a final adjustment

of one stage relative to the other. These concurrent motions must be accompanied frequently by the P.I. to place the individual target images at the center of the view field for optimum viewing and measurement.

(2) To get the full advantage of measuring in stereo (i.e., retaining the three-dimensional effect), the stereo base line of the two conjugate images must be rotated to correspond with the operator's eye base while using the Stereoviewer. On the other hand, in order to make a series of rapid, linear measurements, the image must be successfully rotated to correspond with the scale in the filar eyepiece. However, excessive rotation of the image will destroy the stereo effect or introduce pseudo-stereo. Consequently, the operator should align the filar scale on successive target images by rotating the filar eyepiece in the microscope barrel in concert with concurrent X, Y motions of the film stages.

F. SUMMARY.

(1) To Calibrate Filar Eyepiece

a. Select magnification for measuring imagery and do not change during calibration and measurement.

b. Remove film from Stereoviewer stage.

c. Focus filar scale with black, knurled eyelens cap.

d. Place stage micrometer on microscope stage and focus image with Stereoviewer controls.

e. Align stage micrometer image with fixed filar scale.

f. Check parallax.

g. Align the scales so that the zero lines coincide.

h. Determine stage/filar ratio which equals the subtended stage micrometer distance divided by 10 units on the fixed filar scale.

$$R = \frac{Sd}{10} \qquad \underline{\text{Example:}} \quad R = \frac{18}{10} = 1.8$$

i. Determine ground distance of filar interval on specific photo image, which equals the stage micrometer interval times the scale factor times the stage/filar ratio.

$$FIg = SI \times S.F. \times R$$

<u>Example</u>: FIg = 0.1mm X 30,000 X 1.8 = 5.4 meters.

(2) <u>To Measure Image With Filar Eyepiece</u>

a. Position target image in center of view field.

b. Rotate filar eyepiece until the short crosshair coincides with the dimension to be measured.

c. Obtain initial filar seeting by positioning crosshair at "right" edge of image and noting scale and drum reading (FR_1).

d. Align crosshair with "left" end of image and note scale and drum readings (FR_2).

e. Obtain total filar reading (FR) by subtracting the second reading from the first.

$$FR = FR_1 - FR_2$$

<u>Example</u>: FR = 7.79 - 3.50 = 4.29

f. Determine true ground distance of image which equals the filar reading times the filar interval ground distance.

$$GD = FR \times FIg$$

<u>Example</u>: GD = 4.29 x 5.4 = 23.17 meters.